An Essay

on

Compression of the Brain;

Submitted to the Examination

of the

Revd. J. Andrews; D. D. Provost;

The Trustees

And Medical Faculty of the

University of Pennsylvania,

For the Degree of Doctor of Medicine.

By James H. Noel Essex county Virginia

1812

The

the atten

of Hypoc

although

been mo

ment o

perfectly

t as th

ion (fo

suppose

thing re

ably inve

connectin

of it,

to becom

a dread

The intricacy of this disorder, has engaged the attention of many writers from the days of Hypocrates down to the present time: and although some valuable improvements have been made, by modern Surgeons, in the treat=
=ment of it; yet it appears still to be im=
=perfectly understood. However, I have selected it as the subject of this essay, not with a view (for I have not the presumption to suppose myself capable) of advancing any thing new, or elucidatory of what has been so ably investigated before; but my object is, by consulting the various authors who have treat=
=ed of it, comparing their different opinions &c. to become as well acquainted as I can with a dreadful affection to which man is so

liable,

must e

may be

fractures

the cran

tion of

hydrocep

bone from

two last

nuts com

treat of

external

distinguis

apparent

most co

St.

Depreg

liable, and with which every practitioner must expect frequently to meet.

Compression of the brain may be produced by various causes; such as, Fractures attended with a depressed portion of the cranium, Extravasation, and the Formation of matter. It may also be caused by Hydrocephalus internus, or by a thickening of bone from disease, as in the lues venerea. The two last mentioned causes will not be taken into consideration; but I shall endeavour to treat of the three first, as occurring from external violence, by describing their symptoms, distinguishing them from other affections apparently similar; and indicating the means most commonly employed in the cure.

1st. Of compression of the brain from depressed Fractures.

The Symp
and vol
and nose
vomiting
at least,
same, o
which c
all the
in the
different
them v
that it
very depr
but that
of ten
I believe
day wh

The Symptoms are stupor, drowsiness, loss of speech and voluntary motion, hemorrhage from the ears and nose, sickness at the stomach succeeded by vomiting. These symptoms, or a part of them at least, when produced by the above mentioned cause, occur immediately after the accident; which circumstance distinguishes this from all the other causes of compression.

In the treatment of Fractures, authors are of different opinions, and none more exceptionable than the justly celebrated Pott. He asserts that it is not only indispensably necessary that every depression of the cranium should be elevated but that we should operate in seven cases out of ten in simple undepressed fractures: but I believe there are very few of the present day who would not object to this doctrine.

would
in no ca
fracture
there in
brain, or
fractured
inflamma
ight to
t can
ments o
y opinio
a prev
mischief
f inflam
lence o
by the
diminis

I should suppose that it would be necessary to operate in no case, whatever, in consequence of a fracture whether depression existed or not; unless there were obvious symptoms of a compressed brain, or unless it was evident from the fractured points irritating the Dura Mater inflammation might supervene. It is certainly right to raise every depressed piece of bone, if it can be done without perforating Instrument or much violence. But Mr. Pott is of opinion that a perforation should be made as a preventative of future mischief. What mischief can it prevent? Not Inflammation. If Inflammation occur, it is the effect of violence or force done to the head; and certainly the application of Instruments cannot diminish this cause but must rather tend

ut to in
ments cen
attempt t
t, in th
ther, by
nd a se
t is on e
n shoue
ting. I
y many
nun hon
by the
n done
n with
depreciat
ins gin
rity in

tend to increase it. If inflammation exist, fomentations cannot remove it. Why may we not attempt to prevent it, or if it occurs to resolve it, in this part of the system as in any other, by copious Bloodletting, purging, Blistering and a strict antiphlogistic regimen? It is true it is on a vitals organ, and for that reason we should be cautious of precipitately operating. I have seen several instances, and read of many others, where a portion of the cranium has been depressed by external violence (as by the kick of a horse) and the patient has done well without its being elevated, and even without the aid of a surgeon. But why a depression of the cranium should not at all times give symptoms of compression, since its cavity in health is completely filled, I am not

able to account, unless as Doctor Physick has sup-
posed it probable, that the pressure is made on
the longitudinal sinus. We are told that
sometimes only a portion of the internal table
of the Skull is depressed. It would be well
to have this fact in view in performing
an operation. But I presume no decisive prog-
nosis could be formed of it, unless the first table
were perforated. This, however, could not be mate-
rial in determining on an operation; for I am
persuaded that when the symptoms of a
compressed brain are distinctly marked, whether
produced by bone or any other cause, we should
never hesitate with regard to perforating the
cranium: the mode of doing which, by the
trepline will hereafter be described. Though I
am inclined to think that the saw invented by
Mr. Hey will be found preferable in most cases

of injury from depressed fracture, especially when it would be necessary to apply the trephine more than once.

2nd. Of Compression of the brain from Extravasation. This Extravasation of blood or serum may be the effect of ruptured vessels, either between the cranium and dura mater, the dura & pia mater, the pia mater & the brain, or in the ventricles of the brain. The Symptoms of Extravasation are nearly the same as those occurring from depressed fractures, with which it is often accompanied, and from which it may be distinguished by not occurring immediately & suddenly, but gradually with an interval, generally, between the time of the accident and the time of compression long or short in proportion to the size of the ruptured vessels. Extravasation is also often accompanied with Concussion or Commotion of the brain. When the Concussion is slight or of

[illegible] our [illegible]

[illegible] [illegible]

[illegible] effusi[illegible]

[illegible]bility.

[illegible] bran[illegible]

[illegible]greater [illegible]

[illegible] [illegible]

[illegible]mpreger[illegible]

[illegible]tter cel[illegible]

[illegible]gement[illegible]

[illegible] the [illegible]

[illegible]multer-[illegible]

[illegible] [illegible]

[illegible] [illegible]

[illegible] obstr[illegible]

[illegible]ensiv[illegible]

[illegible]ed to c[illegible]

confeg[illegible]

most duration, the Patient generally recovers his senses, and after a while, according to the degree of effusion, again relapses into a state of insensibility. But when the concussion is considerable the brain much disordered, I believe there is no greater desideratum in Surgery than some decisive mark whereby to distinguish it from compression. No part of the profession appears better calculated to embarrass & perplex the judgements of the inexperienced Surgeon than this. In the various authors that I have anxiously consulted on this point, I am sorry to say I have found nothing positive or determinate; they all with one voice acknowledge it dark and obtruse. Mr. I Bell, by ridiculing the term concussion & reasoning analogically, has endeavored to cast some light on it, but it must be confessed his rays are faint & glimmering.

He says, "There is every reason to believe concussion to be a effusion into the substance of the brain resembling the ecchymosis of a bruised limb, attended with symptoms resembling Apoplexy & terminating usually in a gradual absorption and slow recovery; sometimes in high inflamatory action & sudden delerium, in Typhomania: While compression, proceeding from Extravasation of blood, is plainly palsy; begining in Stupor, without insensibility and ending in hemiplegia & convulsion". He also observes in another place, when speaking of concussion that the Patient, "When lifted from the ground, is found cold, pale, motionless, without pulse, without sense and is as in a fainting fit; if he continues cold & passes his urine & feces involuntarily, he dies"; and goes on to say if he does well this state will be succeeded by high arterial action accompanied with delerium, which last are good

Dire

of

the unc

nerous,

passing

sometimes

for often

Fusion.

attended

the extrem

is about

sensed

Bello

not;

not impe

ion.

an im

progrin

signs. And when speaking of compression from effusion of blood, says, "The Patient is never insensible unless he is about to expire and rarely delirious; his pulse never rises but is slow, heavy & pausing at every fifth stroke; his pupil is sometimes dilated, one side usually paralised, the other often shakes with a sort of tremulous convulsion, which returns at regular intervals; & is attended with a quivering irregular pulse, cold extremities & involuntary evacuations when he is about to expire". I cannot say from experience whether the distinctions drawn by Mr. Bell hold good in practice, I fear they do not; if they do they certainly should have great influence in directing the mode of practice. Some authors regret that we have not "an infallible rule whereby to distinguish what the pressing fluid is". This is a practical point

can

tions a

have

ascert

to

ity

Ethnar

eterna

. Des

tution

ly, cong

ebolomy

peb and

as Nine

ume. W

peb, it

Cranium

the dens

ber one

view can be of no importance. When the symptoms of compressed brain are truly marked, as I have before said, the only indication then, is to ascertain the seat of pressure, and endeavour to remove it. The seat of pressure we are commonly led to by an injured scalp or fracture but extravasation sometimes takes place without any external mark of violence to indicate its seat. Here again we are in the dark. In this situation Mr Pott, tho' a bold operator, has justly confessed, "the only chance of relief is from phlebotomy and an open belly" These together with perfect quietude & low diet should be carried as far as the state of the system will possibly admit. Mr Cooper observes If the symptoms are urgent, it certainly might be proper to perforate the cranium in the course of the spinous artery of the dura mater. If no blood should be found under one parietal bone, the operation might be

the
to corot
quence
large
He alr
the Dem
funct
to se
the lase
mably D
ater heat
e are di
the ther
ake gene
possible
Hour
the the
mme
the deser

ture on the other." Thus Mr. Abernethey's observations go to coroberate; he is of opinion that serious consequences will seldom result "unless one of the large arteries of the Dura Mater be wounded." He also mentions "If there be so much blood on the Dura Mater as materially to derange the functions of the brain;" he believes "the bone so situated will not be found to bleed." This last circumstance, I presume, would measurably depend on the length of time the Dura Mater had been seperated from the bone.

We are directed by Mr. Bell, in difficult cases, where there is no external mark to direct, to make general pressure over the head, and by this, possibly, some tender spot may be discovered. However if we can, by any means determining on the situation of the pressure, we should then immediately operate, in the manner hereafter described: and after a sufficiency of bone is

Dwell
merely
the op
between
merely - b
which
the per
fingers
Poll he
fold he
upsey, t
within
at this
every c
reduced
upon e
meas re
which
ceo.

removed, if the fluid be found on the Dura Mater it may generally be removed, the symptoms relieved & the Patient may do well. But if the fluid be between the Dura & pia Mater the case is extremely hazardous. This may always be suspected, when the Dura Mater is found to protrude at the perforation, giving a sense of tension to the fingers, and the symptoms not mitigated. Mr Pott here recommends that the Dura Mater should be punctured; and also the pia Mater if necessary, that is, if the cause of pressure be situated within it. But Doctor Physick is of opinion that this mode of practice is highly improper: in every case where he has seen the Dura Mater punctured, Inflamation & death have been the uniform consequences; and therefore he prefers the general remedies, particularly copious Bloodletting by which treatment he has known several to do well.

[illegible]

[illegible] of [illegible]

[illegible] of [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] upon

[illegible] health

[illegible] house, i[illegible]

[illegible] to pr[illegible]

[illegible] means

[illegible] Symptom[illegible]

[illegible] indic[illegible]

[illegible] ought in[illegible]

[illegible] the hea[illegible]

I now come to speak of the third and last proposed cause of Compression of the brain, viz. The Formation of Matter within the Cranium. This is generally the consequence of Inflammation; This inflammation may be produced by Contusion, Concussion or Fracture. In order to understand this rightly Mr. Pott tells it is necessary to know that the vessels of the pericranium, those of the diploe, those of the Dura Mater within do all constantly & freely communicate with each other, and upon this freedom of communication depends the health of the parts. Therefore whatever tends to bruise, irritate, or disorder the circulation, must tend to produce inflammations, unless prevented by the means commonly employed for this purpose. The Symptoms, I presume, are generally similar to those indicating Inflammation of any other parts, though in a more violent degree; such as pain in the head as if bound by a cord, restlessness,

out or re
the femu
ipon (sigm
Convexion
prefsion
ques of
tion b
the ac
ous. Th
g from
pear in
accide
mmatio
pur soon
uts, and
It was
at the
' membr
wd; but

want of sleep, hard & frequent pulse, hot & dry skin, flushed face, inflamed eyes, nausea, vomiting rigors (sign of suppuration) and towards the end convulsion & delirium. This cause of compression may be distinguished from all other causes of compression, from concussion or commotion by the long intervals between the time of the accident & the occurrence of the symptoms. The symptoms of a compressed brain, arising from other causes, or those of concussion appear instantaneously or in a short time after the accident; whereas those arising from the formation of matter from inflammation seldom occur sooner than several days, sometimes several weeks, and in a few cases in several months.

It was the general opinion of former surgeons, that the matter or pus found on the brain or its membranes, was originally effused or extravasat blood; but this is obviously incorrect, as has been

satisfactorily proved by Mr Pott and others.
Inflammation of the membranes or brain is often the effect of contusion. The first symptoms are, pain in the part which received the blow, which is soon extended over the head, attended with languor or a dejection of spirits, which is soon followed by a nausea and an inclination to vomit, a vertigo or giddiness, a quick & hard pulse, and an incapacity of sleeping at least quietly.
While the Patient is in this condition, if the Practitioner were to confine him to a dark & quiet room, bleed copiously (five or six times a day if the state of his system would admit) shave the head and blister it over, (which last is strongly recommended by Doctor Physick) and confine him to a strict antephlogistic regimen; I am confident he would seldom find himself compelled to resort to that disagreeable, dangerous & last alternative the operation. But if this plan be not pursued

the symptoms must go on to increase; the part injured will become tumified, soft, tender & pappy; if the Pericranium be examined, it will be found seperated from the cranium and the bone of a whitish colour; the wound discharging, in stead of pus, bloody serum or a dark coloured ichor. In this situation Mr. Pott would say apply the Trepline without hesitation, remove a portion of bone, and you will find the Dura Mater detached from the skull and a quantity of matter (the cause of compression) situated either upon or within it. This admonition would be just & right; for no doubt the process of suppura has taken place, matter has formed and is forming and unless vent is made for its discharge, the symptoms, to use the words of the learned author every hour after this period are exasperated, and advance with hasty strides; the headach & thirst become more intense, the strength decreases, the

rigors are more frequent and at last convulsive motions, attended in some with delirium, in others with paralysis or comatose stupidity, finish the tragedy. In the above I have spoken chiefly of that inflammation & suppuration occurring from contusion; but from whatever cause they may proceed the febrile symptoms are not materially different. If the scalp be wounded or cut, though appeared to be doing well, will have its aspect considerably changed upon the occurrence of fever. The edges of the sore will become hard, painful, pale, lose its granulating surface and discharge only a thin discoloured sanies; the pericranium will be found, also, seperated & the bone discoloured. These two last mentioned symptoms appear to have determined Mr. Pott, not only with respect to the propriety of operating, but also with respect to the detached space of the dura mater, & portion of bone to be removed.

If concussion be the cause of Inflammation, the first symptoms generally disappear, and the Patient appears to enjoy health; but in a few days, or probably weeks, according to circumstances, the symptoms of Inflammation succeed, which from this cause above all others should be resolved if possible; for here, generally speaking, it is not only more extensive, but we have no guide whatever to conduct us to the seat of matter when formed.

Inflammation is not unfrequently produced by a combination of causes; but let it be produced by what it may the indications are the same that is to resolve it if possible; But if in spite of remedies suppuration succeeds and the compressed brain is evident, an vent must be immediately made, if there be a spot to warrant the application of an Instrument. The mode of doing this I will now endeavour to describe.

Trap

tion of

ing and

experience

found &

y a rice

ulin to

which a

perfe

y prefer

lso act

rom ne

forming

opposition

ng, ing.

ne tem

ter mu

ntinued

Trepanning. This should rank among operations of the first importance in Surgery; though safe and simple in the hands of a skilful and experienced operator, yet it is one on which the young & inexperienced cannot too much reflect: It is one that requires judgement & skill, not only to know when it should be performed, which is of the first moment, but also how to perform it. and it is one "that the removal of pressure off the brain, which pressure must also actually occasion dangerous symptoms", can form the only true & vindicable reason for performing it. However, when from the various symptoms given before, it is judged indispensably necessary, it should not be delayed. and the five things to be provided are the Instruments. Here much might be said with respect to the awkwardness & cruelty of those used by the antients,

and with respect to the propriety or impropriety of many described by the moderns. But as Practitioners of the present day appear, pretty generally, to with regard to those that should be used; and as a knowledge of their form, size, figure &c. may be best obtained by ocular demonstration, I shall proceed to describe the Operations as taught in this University. The Instruments to be gotten in readiness are 1st a Scalpel provided with a steel edge at the end of the handle; 2nd the improved Trepheno or two of the same size would be better; 3rd an Elevator; 4th a Toothpick; 5th a small brush; and 6th Tenaculum, needles, ligatures & sponges. The Patient's head (if it has not been done) should now be shaved, or at least so much of the hair should be removed, as necessary. He should then be laid on a Table with his head on a pillow secured & supported by assistants. The seat of injury should now again be examined. and then

you cancel
cured Sc
is very
fracture
upon the
you may
happen to
you can d
through t
and. gua
the bon
and the
moved.
be re
diately
ortune h
ets done
extent.
distinguis
easily a

is one caution of high importance to the inexperienced surgeon, that is in examining a tumor he is very liable to be deceived by a sensation of fracture when in fact there is none.

Upon the nature of the case depends the next step; this may be easily ascertained, if the Integuments happen to be lacerated & the cranium exposed; if not, an Incision should be made with the Scalpel through the Contusion or Tumor down to the bone; guarding, at the same time, against a fracture, least the Knife might slip thro' and injure the brain. No part of the Scalp should be removed; a simple or crucial incision is all that can be necessary. Any hemorrhage must be immediately stoped by pressure or ligature. If a Fracture be found, the Incision should be continued in its direction if it is judged necessary to discover its extent. It has been mentioned by some as difficult to distinguish a Fracture from a suture; but this may be easily ascertained, first by an anatomical

knowledge

knowledge of the parts; secondly, by a Fracture being always rough; & thirdly, by the Pericranium adhering firmly to a Suture, but not to a Fracture.

When the Fracture is accompanied with depression it should be raised by the Elevator; if this can not be done, the judgement of the Operator must determine whether the saw be preferable to the Trepline; in most of these cases I think it will be found preferable, especially where it is judged necessary to remove a long, narrow or large portion of bone. If the preference be given to the Trepline the Pericranium should be scraped off with the handle of the Scalpel, and the center pin fixed on a sound part of bone, but so as for the circle of the saw to include a portion of the Fracture. The center pin, being movable, at first should protrude beyond the teeth of the saw, & be raised gradually as the Perforation is going on, until the Trepline becomes steady, then it should be finally removed. The groove should often be examined with the Toothpick, not

way to
much se
he bee
ost. wit
ion the
ould he
ra man
Elevat
y also b
ne auth
en the
reiect a
those a
fonation
monuly
Elevation
accompa
such an
en where
et to ne
invect h

not only to know when it was nearly thro', but also on which side to bear the saw. During this time, if there be but one saw, an assistant should be engaged, with the Brush or Towel, in cleaning its teeth. When the saw is found to be nearly through, it would be better for fear of its teeth injuring the dura mater, to break out the piece of bone with the Elevator; the splinters of bone if there be any may also be removed by the same instruments.

Some authors mention the diploe as a guide for knowing when the saw is nearly through, but this should not be relied on, for many parts of the cranium, especially those of old persons have no diploe. After the perforation is made the depressed portion of bone may commonly be raised by introducing one end of the Elevator and bearing on the other. If the depression is accompanied with extravasation it will probably be discharged thro' the perforation.

When there is no fracture, and the operation is performed to relieve pressure from blood, serum or matter it should be conducted in the same manner.

How

how often the Trephine should be applied, the circum=
stances of the case and the good sense of the Surgeon
can alone determine: It is certainly right to remove
so much bone and only so much as will permit the
cause of pressure to be discharged.
After the removal of bone, if we find the cause of
pressure situated upon the Dura Mater, we conclude
(this for it is favourable); it may be discharged
thro' the perforation, and the symptoms of a com=
pressed brain relieved. But on the contrary, if the
cause be situated under ~~in~~ within the Dura Mater, we
must halt, reflect & proceed no farther; but rather
by what virtue there is in general remedies,
such as most copious bloodletting, cathartics, blisters
low diet, rest &c. Mercury is also recommended by
Doctor Rush in difficult cases, the good effects of which
he has witnessed in the Pennsylvania Hospital.
But when the symptoms are extremely urgent, the Dura
Mater much protruded, its colour altered &c. I am dis
posed to think, it would be wise as the last

alternative

matives.

to when

proposed

causes

in mete

much ha

tion com

from ev

any p

nating

ceo be

rave, Ce

sir Thoy

produced.

morning

cinected

introduce

unbeted

ubet by

ith the eg

alternative, to puncture it with the point of a lancet. But when reduced to this extremity, the Patient is truly in jeopardy; and we may now with propriety say "Hic casus est de his, e quibus non evadunt aliqui nisi mutta Dei".

Much has been said with respect to operating on particular parts of the cranium; but I believe surgeons of the present day seldom hesitate to operate on any part that may require it. However in operating on bone of irregular thickness the surgeon should be particular in frequently examining the groove; and when the saw has entered at one part Doctor Physick, in order to defend the Dura Mater, has introduced, with advantage, a small spatula.

Hemorrhage from any of the vessels may generally be checked by pressing with the finger for some time or introducing a small bit of lint; or when the artery is embedded in bone a small cedar plug as recommended by Doctor Physick.

With regard to dressing the wound after the

operation

ration
in scalp
ever su
lor May
row, th
th blood
man' s
fore he
removed
beginn
in
be Tim
and S
ent stic
fined to
gentle
nately, ne
ent an
settling

operation most Practitioners recommend the flaps of the scalp to be laid down, and a little soft lint covered with a simple ointment to be applied; but Doctor Physick objects the use of lint for this good reason, that the lint generally becomes encrusted with blood or some fluid & is very difficult to remove without much irritating the parts; and therefore he prefers a soft poultice which can easily be removed & renewed as occasion may require. The Dressings are best retained by a common night cap.

After the wound is dressed the Practitioner's attention should then be turned particularly to guard against Inflammation and Symptomatic fever. In order to effect this, his Patient should be committed to a dark & quiet room; confined to a low diet, and his bowels kept regular by gentle laxatives. But if symptoms of fever, unfortunately, supervene, we must immediately fly to the lancet as our chief aid; in no case probably is blood-letting so copiously required. This together with

bleeding

blisters and the antiphlogistic plan must be strictly adhered to.

Thus have I treated the subject; and altho' I have spoken of external violence as the remote cause, yet compression, no doubt, frequently occurs from other causes; and often appears in the form of the most formidable diseases in the nosologic catalogue. Indeed such is the sympathy existing between this organ (the brain) and the other parts of the system that in no disease should it escape the attention of the Practitioner. Its functions &c. are, however, at present so imperfectly known, that it would be presumption in me to say any thing farther. I shall therefore conclude hoping, with Doctor Cullen, "Dies docebit". But before I conclude I humbly tender my cordial thanks to the Medical Profession, collectively & individually, for the much information I have obtained from their lectures; and that they may long live to occupy the chairs which they now so ably fill is the fervent wish of their devoted Servant. —